

Principles of Biomechanics vs Sport  
Text p231-234

### Principle #1

#### Stability of an athlete is dependent upon the athlete's Center of Mass (C of M)

To increase stability an athlete can;

- Lower his/her C of M
- Create a larger base of support
- Center C of M within the Base of Support
- Increase Mass

Nov 23-7:16 AM

### Application of this Principle

- Gymnastics - tripod for headstand
- Football- running back lowers his/her C of M while clearing the line of scrimmage
- Football- three point stance
- Cheerleading Base of the Pyramid
- Self Defense- properties of the *throws*
- Hockey -Hip-Check (Body Checking)

Nov 23-7:22 AM

### Assignment

Create notes outlining each of the principles 2-6

Create 4 or 5 points of reference

5 applications to sport

(be clear and descriptive when outlining how each principle applies to various sports)

Nov 23-7:28 AM

**Principle #2**  
The production of maximum force requires the use of all possible joint movements that contribute to the task's objective (*Kinetic Chain*).

- With more joints being used in a skill, the more muscles there will be to contract
- Athletes are encouraged to use slow, controlled, high-intensity movements (to activate more of the joint, it needs to have rhythm)
- In practical theory, the more joints that are used, the more controlled muscles become
- By effectively applying this principle, athletes can avoid injury and perform more efficiently

Applying this principle:

- All sports can be applied to this principle of physics
- Volleyball - use the wrist more in a spike
- Tennis - bringing in the elbow and wrist
- Golf - novice golf swing just uses the arms, practice golf swing starts from the core

**Principle #3**  
The production of maximum velocity (speed) requires the use of joints/muscles in order from largest to smallest.

- The larger joints are the ones that move first, then the smaller joints begin to follow through
- Main objective is to have reached maximum velocity at time of impact with object (critical instant)
- The longer the actual movement, the greater the final velocity (at impact)

Applying this principle:

- Baseball - the pitching of the fastball (comes from the core and footwork)
- Application of a jump shot or free throw
- Spike in volleyball

**Principle #4**  
The greater the applied impulse, the greater the increase in velocity.

- When an activity requires a maximum application of force, it follows that the joint involved will go through a longer range of motion
- During the critical instant phase, the athlete applies selected force to attain final velocity
- Greater that impulse, the greater the final velocity

Applying this principle:

- Cushioning/crading the sports ball when thrown
- Drop shot in badminton

**Principle #5**  
Movement usually occur in the direction opposite that of the applied force.

- When the athlete exerts a force, the surface pushes back with the same force and in the opposite direction
- Limiting opposing forces (ie. friction, air resistance) results in a requirement of less force applied

Applying this principle:

- Linebackers in football - planting their feet in the ground, pushing off
- Rowing/Canoeing - pushing against the water with the paddles to propel the boat forwards
- Tag of feet - same scenario as football, planting their feet
- Swimming - having the water be the opposing force for swimming technique
- Bungee jumping - tension of the cord tethering to your body
- Coasting in cycling

Nov 22-11:46 AM

### Principle #6

#### Angular Motion is produced by the application of a force acting at some distance from an axis that is, Torque.

Athletes are concerned with three kinds of rotations produced through torque.

- Rotation of their entire body
- Rotation of individual body segments
- Rotation of projectiles

In order to create a spin, hit the object off the center of gravity(Mass)  
By manipulating your body you can force an object in certain directions ie. spinning a body or a ball

#### Application

Baseball -performing a curve ball by putting your hand on the ball to manipulate the center of mass

Football/Rugby - having a directional punt

Discus - using your core to make rotational force to produce highest final velocity

Figure Skating - small to large moment arm

Pool- Hitting the ball at the bottom of the cue ball to create backspin ( any strike off the center of mass will perform a different action)

Nov 23-7:32 AM

Pool- Hitting the ball at the the bottom of the cue ball to create backspin ( any strike off the center of mass will perform a different action)

Nov 23-8:17 AM

Principle #7

Angular Momentum is constant when an athlete or object is free in the air.

- increase force exerted on ground/surface
- decrease the length of moment arm to increase momentum
- the surface one initiates the force on has a factor in the height and/or speed of the object ie. jumping off a solid surface or jumping off a diving board

Applications

Diving- divers can get into a tuck position to spin faster and straighten upon entry into the water

Gymnastics- a vaulter in gymnastics exerts a lot of force backwards which allows them to spin very rapidly throughout a maneuver

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Assignment

7 Principles of Biomechanics vs Sport

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Nov 25-12:47 PM

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